Call for Study Concepts

to be considered for further development and funding as part of the
2010 IEP Pelagic Organism Decline Workplan

I. Synopsis

The Interagency Ecological Program for the San Francisco estuary (IEP) is soliciting study concepts to advance the understanding of ecological processes that control the population dynamics of delta smelt (*Hypomesus transpacificus*) and other pelagic organisms implicated in what has become known as the "Pelagic Organism Decline" (POD). We are particularly interested in study concepts exploring mechanisms by which variation in fall flows may affect delta smelt population dynamics. Study concepts about other ecological drivers and processes affecting delta smelt and other pelagic organisms in the San Francisco estuary are also invited.

II. Overview

The POD is the focus of a broad research program about the effects of habitat characteristics, sources of mortality, stock-recruitment effects, and food availability on pelagic organisms in the San Francisco estuary. One important concept that has emerged from this research is that the fall (September-November) location of the low salinity zone in the San Francisco Estuary is an important factor for the pelagic fish community, particularly delta smelt. The 2008 U.S. Fish and Wildlife Service (FWS) OCAP Biological Opinion requires that the two parts per thousand isohaline (X2) in the fall is located no more than 74 km from the Golden Gate following "Wet" water years and 81 km following "Above Normal" water years. To achieve these conditions, average fall outflows must be approximately 11,000 cfs in "Wet" years and 7,000 cfs in "Above Normal" years. In all other water year types, outflows are expected to remain at the recent levels of 3,500-4,000 cfs. We are seeking focused study concepts about how the location of X2 in the fall and associated variation in fall flows may modulate the effects of other ecological drivers on delta smelt population dynamics. In addition, we are also interested in study concepts related to other POD topic areas (described in Sommer et al. 2007 and Baxter et al. 2008). **These study concepts will be considered for further development and funding as part of the 2010 IEP POD workplan.**

III. Participation and Funding

Any public agency, university, nonprofit organization, or private party capable of entering into a contract or grant agreement with the State or Federal government may submit a study concept. The anticipated amount of total funding is approximately one million dollars. The anticipated funding length is one year with a possibility (but no guarantee) of no-cost extensions and funding supplementation or renewals.

IV. Submittal Requirements

The deadline for submission of study concepts is OCTOBER 25, 2009.
Complete the attached study concept form and email it to iep_2010concepts@usbr.gov by October 25, 2009. Please attach a statement of your qualifications or Curriculum Vitae, but do not append any additional material to the form. You may briefly provide additional information in a cover letter written within the body of your email.

V. Study Concept Review and Selection

Study concepts will undergo internal IEP merit review by IEP Management Team members and IEP Coordinators. They will be evaluated and selected based on

compliance with the submittal requirements, overall intellectual merit (includes likelihood of advancing knowledge, scientific soundness, originality, creativity, clarity, and logical organization), feasibility, likelihood of success, responsiveness to the priority research topics outlined below, and the qualifications and past performance of the applicants.

VI. Selection Notification and Next Steps

Notifications about selection results will be sent to all study concept authors by November 6, 2009, and full proposals may be requested at this time. Full proposals may be subject to additional independent scientific peer review as part of a larger review of a draft 2010 POD workplan anticipated to occur December 2009 - January 2010. Final notification about funding will be given after approval of the 2010 POD workplan by the IEP Agency Directors that is expected to occur in March 2010.

VII. Priority Research Topics

The study concept priority topics are derived from the conceptual model guiding the pelagic organism decline investigations (described in Sommer et al. 2007 and Baxter et al. 2008). The specific questions under each priority topic were developed and discussed at a public workshop held in Sacramento on June 18, 2009, and refined by IEP staff.

Topic 1: Habitat effects on delta smelt population dynamics.

Background:

The habitat quantity and quality experienced by delta smelt is characterized by many biotic and abiotic variables. The focus here is on gaining a better understanding of the abiotic habitat variables that may most affect delta smelt habitat in the fall, and their relationships with flows and habitat conditions during other times of the year. Habitat effects of particular interest include those exerted by well documented water quality variables such as salinity and turbidity, but also less commonly addressed contaminant effects and toxicity.

Specific questions to address:

A. How can existing or new monitoring data, modeling, or other methods be applied to better define and monitor delta smelt habitat?

B. What is the frequency of occurrence and distribution of acute and chronic toxicity of ambient water to delta smelt and their food items, and how is it affected by flow variability?

C. What are the distribution, transport, fate, concentration, and effects of contaminants including pesticides, ammonia, and metals that may have lethal or sublethal effects on delta smelt and their food items in the low-salinity zone, and how are these affected by flow variability?

D. What are the production, distribution, transport, fate, concentration, and effects of toxins released by harmful algal blooms that may affect delta smelt, and how are these affected by flow variability?

E. How do abiotic or biotic conditions during spring and summer affect flow effects on delta smelt habitat and ecological processes important to delta smelt during fall?

Topic 2: Food web effects on delta smelt population dynamics (bottom-up effects).

Background:

This research topic is intended to provide new insights into the effects of interannual flow variability on food web dynamics affecting delta smelt. Juvenile to sub-adult delta smelt consume calanoid copepods, mainly *Pseudodiaptomus*, *Sinocalanus*, and *Acartiella,* in the summer and fall. Food limitation of delta smelt can be inferred from a few lines of evidence. First, glycogen stores of delta smelt in summer 1999 were depleted, which implies food was in short supply for maintenance and growth of individuals. Second, correlative relationships between survival of delta smelt from summer to fall and the abundance or biomass of calanoid copepods are consistent with food limitation of survival. Third, abundance and biomass of calanoid copepods in the low-salinity zone in summer-fall is low compared to that observed in many other estuaries, increasing the possibility that Delta-resident fish are food limited. It is plausible that growth, survival, or fecundity would be higher if the concentration of good-quality food where delta smelt occur were higher. Food limitation may occur continuously or sporadically, and it may be important all the time or sporadically. Food limitation need not necessarily imply starvation.

Specific questions to address:

A. To what extent are individual delta smelt limited by the food supply in the low salinity zone (e.g., as evidenced by their ingestion rate, growth rate, development, health, or survival), and how is it affected by flow variability?

B. What are the food availability and quality for delta smelt in the low salinity zone, and how are they affected by flow variability? This includes, but is not limited to, effects on transport, fate, interactions, community composition, and population dynamics of food organisms, and the effects of flow-related changes in the shape or size of the low salinity zone on the food web.

C. How do nutrients affect the food web supporting delta smelt in the low salinity zone, and how are they affected by flow variability?

D. What are the occurrence, distribution, and intensity of harmful algal blooms and their effects on delta smelt and the food web supporting delta smelt in the low salinity zone, and how is it affected by flow variability?

E. How does *Corbula amurensis* affect the food web supporting delta smelt, and how is it affected by flow variability? This includes, but is not limited to, abundance and distribution (numbers and biomass), biology, and population dynamics.

F. What are the effects of gelatinous plankton in the low-salinity zone on delta smelt and the food web, and how are they affected by flow variability?

Topic 3: Effects of piscivores or water diversions on delta smelt population dynamics (top-down effects).

Background:

This research topic is intended to provide new insights into the direct or indirect effects of interannual flow variability on top-down effects on delta smelt. Top-down effects are predicated on the hypothesis that consumption or removal of delta smelt by piscivores and water diversions (Central Valley Project and State Water Project diversions, power plant diversions, agricultural irrigation diversions) is affected by flow variability. This is likely to occur by any number of factors

(e.g., if piscivorous fishes became more abundant relative to delta smelt; if fish distribution shifted to locations with higher predation or entrainment risk; if delta smelt or their prey became more vulnerable to predation or entrainment as a consequence of other flow-related changes in abiotic and biotic habitat such as changes in turbidity).

Specific questions to address:

A. What is the susceptibility of delta smelt to entrainment in agricultural irrigation, Central Valley Project, State Water Project, power plant plants diversions, and how is it affected by flow variability? What effect do such entrainment have on the delta smelt populations?

B. What is the susceptibility of delta smelt food organisms to entrainment in the Central Valley Project and State Water Project diversions, and how is it affected by flow variability?

C. What is the spatial overlap and encounter rate between delta smelt and potential predators (striped bass and largemouth bass), and how is it affected by flow variability?

D. How does turbidity affect delta smelt predation risk, and how is it affected by flow variability?

Key References (with electronic hyperlinks)

Baxter, R., Breuer, R., Brown, L., Chotkowski, M., Feyrer, F., Gingras, M., Herbold, B., Mueller-Solger, A., Nobriga., M, Sommer, T., and K. Souza. 2008. Pelagic organism decline progress report: 2007 synthesis of results. Available at http://www.science.calwater.ca.gov/pdf/workshops/POD/2007_IEP-POD_synthesis_report_031408.pdf

Bennett, W.A. 2005. Critical assessment of the delta smelt population in the San Francisco estuary, California. San Francisco Estuary and Watershed Science. Vol. 3, Issue 2 (September), Article 1.

Feyrer, F., Nobriga M., and T. Sommer. 2007. Multi-decadal trends for three declining fish species: habitat patterns and mechanisms in the San Francisco Estuary, California, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences 64:723-734.

Kimmerer, W.J. 2008. Losses of Sacramento River Chinook salmon and delta smelt to entrainment in water diversions in the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science. Vol. 6, Issue 2 (June), Article 2.

Kimmerer, W.J., Gross E.S., and M.L. MacWilliams. 2009. Is the response of estuarine nekton to freshwater flow in the San Francisco Estuary explained by variation in habitat volume? Estuaries and Coasts 32:375-389.

Sommer, T., Armor C., Baxter R., Breuer R., Brown L., Chotkowski M., Culberson S., Feyrer F., Gingras M., Herbold B., Kimmerer W., Mueller-Solger A., Nobriga M., and K. Souza. 2007. The collapse of pelagic fishes in the upper San Francisco Estuary. Fisheries 32(6):270-277.